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09/733,474	12/08/2000	Minoru Sugawara	09792909-4740	2651

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EXAMINER

NGUYEN, JOSEPH H

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 05/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/733,474

Applicant(s)

SUGAWARA ET AL.

Examiner

Joseph Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 4-11 and 13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 4-11 and 13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 December 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 13 recites the limitation "said second silicon epitaxial layer...said n channel first silicon epitaxial layer" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim since second silicon epitaxial layer and n channel first silicon epitaxial layer are not recited in claim 4 from which claim 13 depends.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4-7, 11, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo et al in view Imai et al and further in view of Taylor.

Regarding claim 4, Kudo et al discloses on figure 13 a semiconductor device with a p channel and n channel field effect devices formed on a common substrate 10, comprising a silicon substrate 10 with a p channel and n channel field effect regions

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corresponding to said p channel and n channel field effect devices respectively, said n channel field effect region having ...a silicon germanium compound relax layer 15n on said buffer layer and a silicon epitaxial layer 17n formed on said silicon germanium compound relax layer, a concentration of germanium in said buffer layer being graduated so tat it increases proceeding from a substrate side of said buffer layer to a relax layer side of said buffer layer, a concentration of germanium in said relax layer being substantially the same as the concentration of germanium at said relax layer side of said buffer layer, said p channel field effect region having a silicon germanium compound layer 15p formed on said substrate and a silicon epitaxial cap layer 17p formed on said silion germanium compound layer, ...drain and source regions of said p channel field effect device being within said silicon germanium compound layer 15p formed on said substrate and said silicon epitaxial cap layer 17p formed on said silicon germanium compound layer. Kudo et al does not disclose a buffer layer made of silicon germanium. However, Imai et al discloses on figure 3K a buffer layer 12 made of silicon germanium. In view of such teaching, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kudo et al by having a buffer layer made of silicon germanium for the purpose of improving the lattice mismatching and the performance of a semiconductor device.

Kudo et al and Imai et al do not disclose drain and source regions of said n channel field effect device being within said silicon epitaxial layer formed on said relax layer. However, Taylor et al discloses on figure 14 drain and source regions 1116 of layer. In said n channel field effect device being within said second silicon epitaxial layer 1104. In

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view of such teaching, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kudo et al and Imai et al by having drain and source regions of said n channel field effect device being within said second silicon epitaxial layer the purpose of obtaining the high quality of the channel in terms of carrier mobility.

Regarding claim 5, Kubo et al discloses on figure 13 a ratio of germanium to silicon in said buffer layer 14n increases from 0.0 to less than about 0.5 proceeding from said substrate side to said relax layer side of said buffer layer.

Regarding claim 6, Kubo et al discloses on figure 13 the ratio of germanium to silicon in said buffer layer 14n is not greater than about 0.3.

Regarding claim 7, Kubo et al and Imai et al disclose substantially all the structure set forth in the claimed invention except the buffer layer being about 1.68 micrometers thick and the relax layer being about 0.6 micrometers thick. However, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify Kubo et al and Imai et al by having the buffer layer being about 1.68 micrometers thick and the relax layer being about 0.6 micrometers thick for the purpose of improving the performance of a semiconductor device, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 9, Kubo et al discloses on figure 13 said silicon germanium compound layer 15p has a ratio of germanium to silicon of about 0.1 to less than about 0.8.

Regarding claim 11, Kubo et al and Imai et al and Taylor disclose substantially all the structure set forth in the claimed invention except the second epitaxial layer having a thickness of about 100 nm. However, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify Kubo et al and Imai et al and Taylor by having the second epitaxial layer having a thickness of about 100 nm for the purpose of improving the performance of a semiconductor device, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 13, as best the Examiner is able to ascertain the claimed invention, Kubo et al and Imai et al and Taylor disclose substantially all the structure set forth in the claimed invention except in cross section said p channel field effect region silicon germanium layer and said second silicon epitaxial layer occupying substantially the same vertical spacing and position as said n channel first silicon epitaxial layer. However, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify Kubo et al and Imai et al and Taylor by having the in cross section said p channel field effect region silicon germanium layer and said second silicon epitaxial layer occupying substantially the same vertical spacing and position as

said n channel first silicon epitaxial layer for the purpose of improving the performance of a semiconductor device, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 8,10, Kubo et al and Imai et al and Taylor together disclose the structure set forth in claimed invention.

Response to Arguments

Applicant's arguments filed on 1/22/2003 have been fully considered but they are not persuasive.

With respect to claim 4, applicant argues that Kudo et al does not disclose the source/drain regions of the n channel device are provided within the silicon epitaxial layer formed on the relax layer while the source/drain regions of the p channel device are provided within the silicon germanium compound layer formed on the substrate and the silicon epitaxial layer formed on the silicon germanium compound layer. However, Kudo et al discloses on figure 13 the source/drain regions 25 of the p channel device are provided within the silicon germanium compound layer 15p formed on the substrate and the silicon epitaxial layer 17p formed on the silicon germanium compound layer 15p. Kudo et al does not disclose the source/drain regions of the n channel device are provided within the silicon epitaxial layer formed on the relax layer. However, Taylor discloses on figure 3K the source/drain regions 1116 of the n channel device are

provided within the silicon epitaxial layer 1104. Therefore, the combination of Kudo et al and Imai et al and Taylor would read on amended claim 4.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Nguyen whose telephone number is (703) 308-1269. The examiner can normally be reached on Monday-Friday, 7:30 am- 4:30 pm

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned is (703) 308-7382 for regular communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JN
April 30, 2003



**EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800**